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Research Article

Two new species of the genus *Narynia* (Collembola, Isotomidae) from China

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Abstract

Two new species of the genus *Narynia* Martynova from China are described: *Narynia alxaica* **sp. nov.** from the western Inner Mongolia Autonomous Region, northern China and *Narynia ritongensis* **sp. nov.** from Xizang Province, southwestern China. The two new species can be separated from known species by the length ratio (lateral vs. medial) and location of sensilla on abdominal segment V. An identification key to the species of the genus *Narynia* is given.

Key words: Continental Asia, identification key, *Proisotoma* complex, springtails, taxonomy

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Introduction

Narynia Martynova, 1967 is a small genus of Anurophorinae, which has a complete furca with a massive mucro, no anterior chaetae on the manubrium and a cluster of 10 conspicuous erect horizontal chaetae at the tip of the abdomen (Martynova 1967; Potapov 2001; Huang et al. 2010). Furthermore, the genus belongs to the *Proisotoma* complex, which has the following characteristics: reduction of furca variable, none or few anterior chaetae on the manubrium, and the two last abdominal segments clearly separated (Potapov et al. 2006; 2009, 2015, 2021; Huang and Potapov 2012; Potapov and Bogomolov 2016). At present, *Narynia* has four known species and primarily distributed across parts of the continental region of Inner Asia (Martynova and Tshelnokov 1975; Martynova 1981). *Narynia luanae* Huang, Potapov & Gao, 2010 is the only known species found in China (Northwest, Ningxia Province). In the present paper, two new species are described from China: *Narynia alxaica* sp. nov. from Alxa Left Banner, Alxa League, western Inner Mongolia Autonomous Region, northern China and *Narynia ritongensis* sp. nov. from Ritong, Qamdo, Xizang Province, southwestern China.

Material, methods and abbreviations

Samples were collected from the western Inner Mongolia Autonomous Region and Xizang Province of China. Collembola were extracted by Tullgren funnels and stored in 75% ethanol. Later, specimens were mounted on slides using

Hoyer's solution and dried in a drying box at 50–55 °C for five days. The specimens were examined by a Zeiss compound microscope Lab.A1. The figures were drawn using Nikon Microscopic Imaging System and improved with Photoshop CS5 (Adobe Inc.).

Type specimens of the new species are deposited in the Shanghai Entomological Museum, CAS Center for Excellence in Molecular Plant Sciences, Shanghai, China.

Abbreviation used in this study

Abd.I–VI	Abdominal segments I–VI
accp1–4	p-row accessorial tergal sensilla 1–4 on abdominal segment V
Ant.1–4	antennal segments 1–4
bms	basal microsensillum on antennal segments
CAS	Chinese Academy of Sciences
Md, Mdl, Ml	dorsal, dorsolateral, lateral macrochaetae
ms	microsensillum
PAO	postantennal organ
s	sensillum
SEM	Shanghai Entomological Museum
Th.I–III	thoracic segments I–III
Ti.1–3	tibiotarsi of legs 1–3
VT	ventral tube

Results

***Narynia alxaica* sp. nov.**
https://zoobank.org/C52921F3-AB37-4156-B551-CBBBAADCAC95
Figs 1A–E, 2A

Type material. ***Holotype female*** • N China, W Inner Mongolia Autonomous Region, Alxa League, Alxa Left Banner, Yaoba, Qianggang range; mixed coniferous broad-leaved forest, moist sandy soil; 3 Aug. 2010; Cheng-Wang Huang and Yun Bu leg. ***Paratypes*** • N China, four females, four subadult females and subadult male; W Inner Mongolia Autonomous Region, Alxa League, Alxa Left Banner, Yaoba, Xiazi ravine; moist humus soil in the forest; 4 Aug. 2010; Cheng-Wang Huang and Yun Bu leg. Holotype and paratypes deposited in SEM.

Description. Size about 1.2 mm. Colour greyish. Integument appears smooth, slightly polygonal under high magnification, without secondary granulation. All body chaetae smooth. Longest macrochaeta on Abd.IV about 0.3 times as long as tergite length.

Antennal length 0.8–0.9 times as long as head. Ant.1 with 11 ordinary chaetae, 2 bms (dorsal and ventral) and 2 ventral sensilla, the largest twice as long as the shortest. Ant.2 with 18 ordinary chaetae, 3 bms (dorsal, lateral and ventral) and 1 sensillum. Ant.3 with 24 ordinary chaetae, 1 bms and 1 lateral sensillum. Ant.3 organ with 2 inner sensilla (small sensory rods) and 2 guard sensilla (Fig. 1E). Ant.4 with numerous weakly differentiated sensilla, subapical microsensillum and organite present. Apical bulb absent. Ratio of Ant.1: 2: 3: 4 approximately 1: 1.4: 1.4: 2.4.

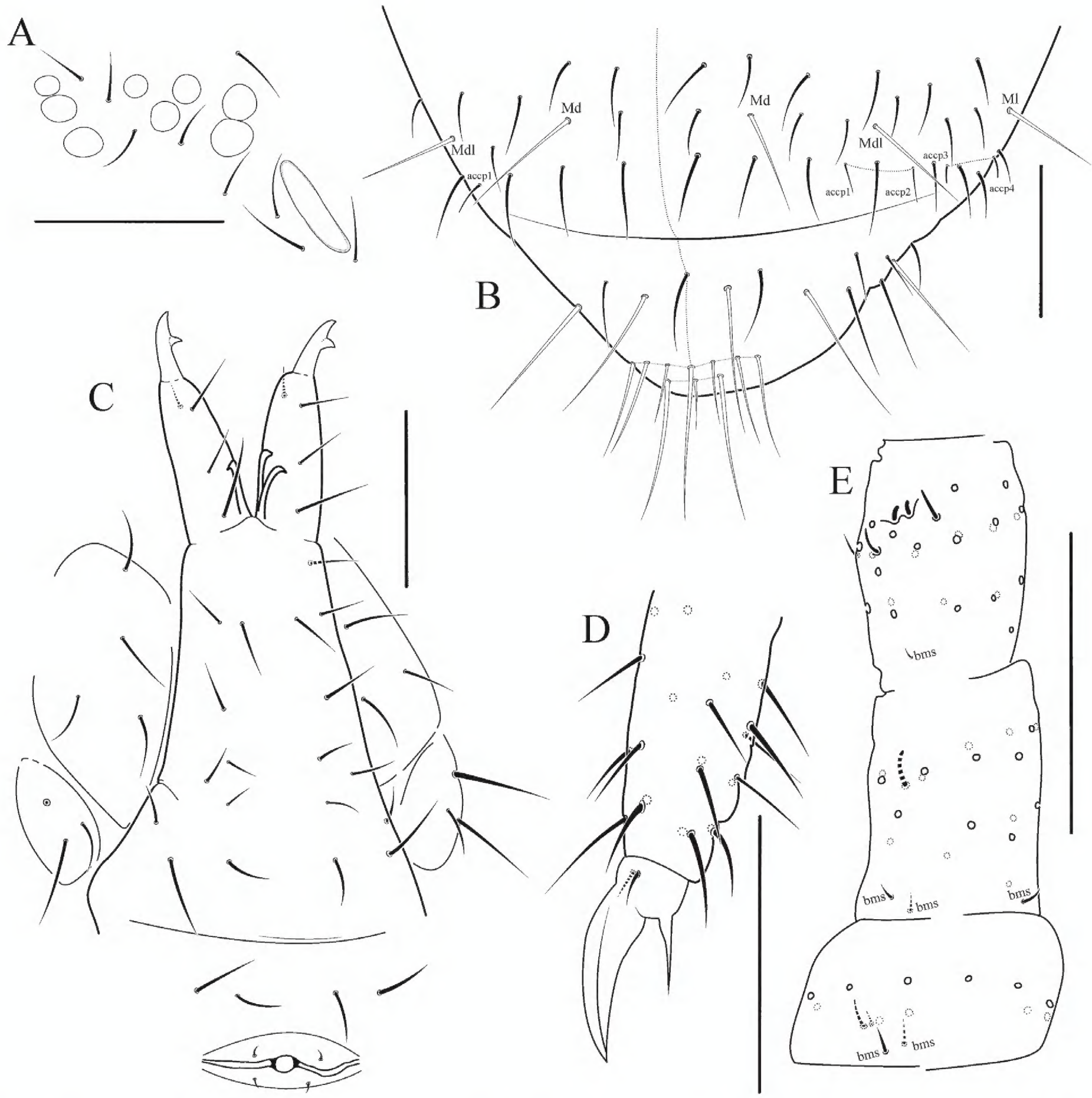

Figure 1. *Narynia alxaica* sp. nov. **A** PAO and ommatidia **B** Abd.V–VI, dorsal view **C** furcal area and female genital plate **D** tibiotarsus and claw of Leg 3 **E** Ant.1–3, dorsal view. Scale bars: 50 μm.

Ommatidia 8+8, G and H smaller, about 0.6 times as long as the diameter of ommatidium A (Fig. 1A). PAO broad, about 2.6 times as long as the adjacent ommatidium and about 1.0 times as long as width of Ant.1 and 1.1 times as long as inner unguis length, with 2 posterior chaetae. Maxillary palp bifurcate, with 4 sublobal hairs and 1 basal chaeta. Four prelabral chaetae, labral formula as 554. Labium with all papillae A–E present, papilla E with 7 guards, 3 proximal chaetae. Basomedial field of labium with 4 chaetae. Ventral side of head with 3+3 postlabial chaetae.

Number of axial chaetae on each side of Th.II–Abd.V: (5)6,4/3,3,3,5(4 or 6),3, sometimes with 1 chaeta on center line of Abd.IV. Dorsal chaetotaxy of Abd.V–VI as in Fig. 1B. Macrochaetae smooth, 1,1/2,2,2,3,3 in number. On Abd.I–II Mdl shorter than Ml, on Abd.V Md about 0.6 times as long as tergite length. Macrosensilla

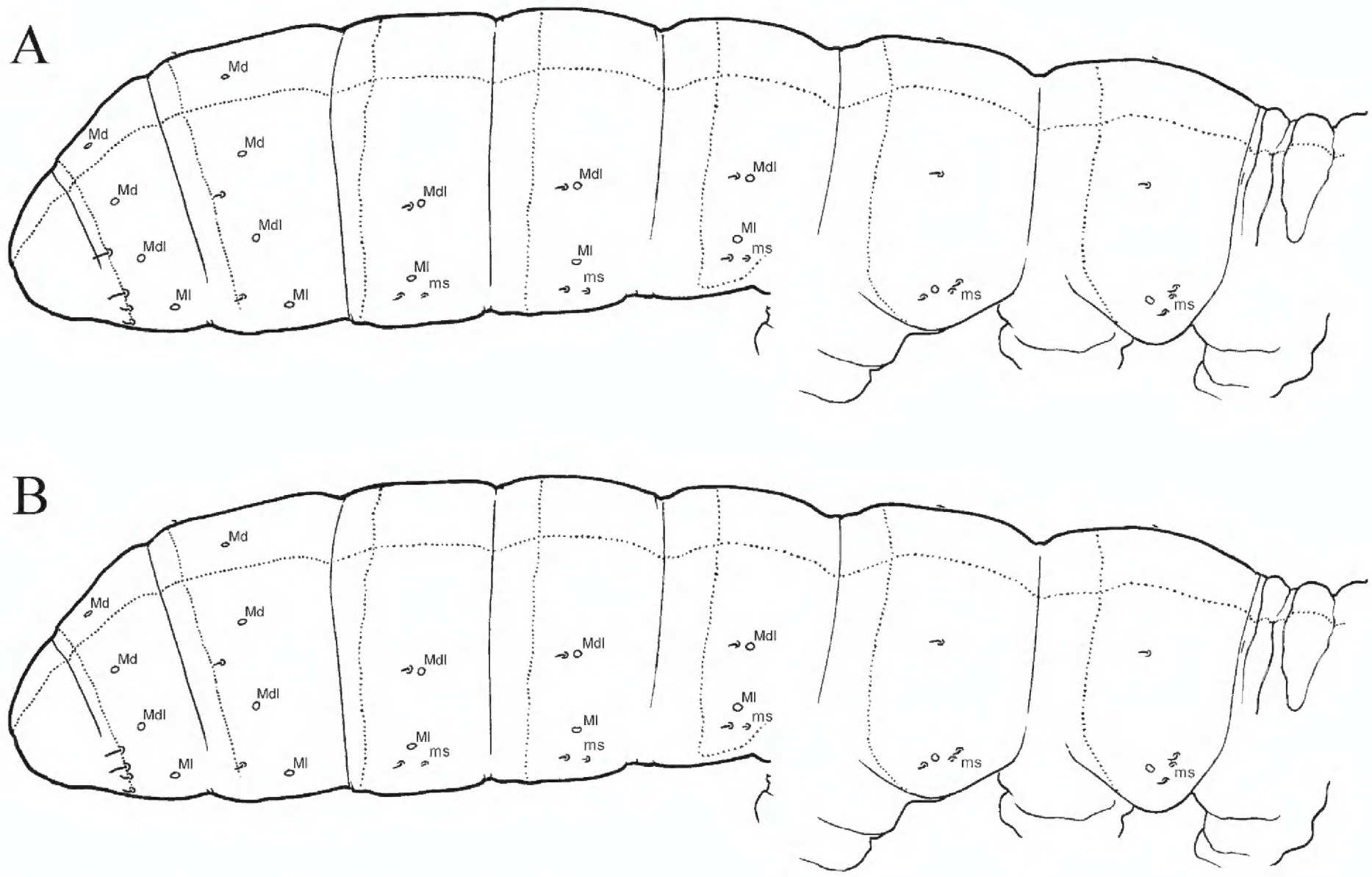

Figure 2. Sensillar chaetotaxy of *Narynia* **A** *Narynia alxaica* sp. nov. **B** *Narynia ritongensis* sp. nov.

on body short and slightly broadened, easily distinguished from ordinary chaetae. Sensillar formula as 33/22224 (Fig. 2A). On Abd.I–III macrosensilla positioned just posterior to Mdl. Abd.V with 2+2 well-marked, short lateral sensilla (accp3 and 4) and 2+2 medial sensilla (accp1 and 2), a little thinner and about 1.9 times as long as lateral sensilla. Microsensillar formula as 11/11100. Thorax without ventral chaetae. Abd.VI with 10 erect horizontal chaetae at tip.

Claw without inner and lateral teeth. Empodial appendage about half as long as unguis, rather thin. Ti.1–3 with 21, 21, 22 chaetae respectively, without clavate tenent hairs. Two inner chaetae on Ti.3 much thinner than others (Fig. 1D). VT with 4+4 laterodistal and 4 posterior chaetae, no anterior chaetae. Tenaculum with 3+3 teeth and 1 chaeta. Anterior furcal subcoxa with 4(3 or 5) chaetae, posterior subcoxa with 3(2 or 4) chaetae. Manubrium without anterior chaetae, posterior with 3+3 laterobasal, 2+2 in distal transversal row, and 4+(3)4 in central part. Dens with 1 anterior and 3 posterior chaetae (Fig. 1C). Mucro massive, bidentate. Ratio of manubrium: dens: mucro = 6.6: 2.5: 1. Female genital plate as in Fig. 1C.

Remarks. *Narynia alxaica* sp. nov. is similar to *Narynia kolimiensis* Martynova, 1981 and *N. ritongensis* sp. nov. They have the same location of the medial sensilla on Abd.I–III, no ventral chaetae on Th.III and the same chaetotaxy of the dens. However, they can easily be distinguished from each other by the location of the medial sensilla on Abd.V. The main differences between the three species are described in the Remarks of *N. ritongensis* sp. nov.

Distribution. Known only from the type locality, the foothills of Helan Mountain.

Etymology. The new species is named after the type locality.

***Narynia ritongensis* sp. nov.**
https://zoobank.org/BB5BC1A5-E2C7-4497-A723-9D1038ECF0BB
Figs 2B, 3A–F

Type material. ***Holotype female*** • SW China; Xizang Province, Qamdo, Ritong; 6 Aug. 2009; Wan-Jun Chen leg. ***Paratypes*** • female and subadult male; same data as holotype. Holotype and paratypes deposited in SEM.

Description. Size 0.9–1.0 mm. Colour greyish. Integument appears smooth, slightly polygonal under high magnification, without secondary granulation. All body chaetae smooth. Longest macrochaeta on Abd.IV about 0.3 times as long as tergite length.

Antennal length 0.8–1.0 times as long as head. Ant.1 with 11 ordinary chaetae, 2 bms (dorsal and ventral) and 2 ventral sensilla, the largest twice as long as the shortest. Ant.2 with 18 ordinary chaetae, 3 bms (dorsal, lateral and ventral) and 1 sensillum. Ant.3 with 22 ordinary chaetae, 1 bms and 1 lateral sensillum. Ant.3 organ with 2 inner sensilla (small sensory rods) and 2 guard sensilla (Fig. 3F). Ant.4 with numerous weakly differentiated sensilla, subapical microsensillum and organite present. Apical bulb absent. Ratio of Ant.1: 2: 3: 4 approximately 1: 1.3: 1.5: 2.2.

Ommatidia 8+8, G and H smaller, about 0.6 times as long as the diameter of ommatidium A (Fig. 3D). PAO broad, about 3.4 times as long as the adjacent ommatidium and about 0.9 times as long as width of Ant.1 and 1.2 times as long as inner unguis length, with 2 posterior chaetae. Maxillary palp bifurcate, with 4 sublobal hairs and 1 basal chaeta. Four prelabral chaetae, labral formula as 554. Labium with all papillae A–E present, papilla E with 7 guards, 3 proximal chaetae. Basomedial field of labium with 4 chaetae. Ventral side of head with 3+(1)3 postlabial chaetae.

Number of axial chaetae on each side of Th.II–Abd.V: 6,5/3,3,3,4–5,3, sometimes with 1 chaeta on center line of Abd.IV or V. Dorsal chaetotaxy of Abd.V–VI as in Fig. 3A, B. Macrochaetae smooth, 1,1/2,2,2,3,3 in number. On Abd.I–III Mdl shorter than Ml, on Abd.V Md about 0.6 times as long as tergite length. Macrosensilla on body short and slightly broadened, easily distinguished from ordinary chaetae. Sensillar formula as 33/22224 (Fig. 2B). On Abd.I–III macrosensilla positioned just posterior to Mdl. Abd.V with 2+2 well-marked, short lateral sensilla (accp3 and 4) and 2+2 medial sensilla (accp1 and 2), a little thinner and about 1.6 times as long as lateral sensilla. Microsensillar formula as 11/11100. Thorax without ventral chaetae. Abd.VI with 10 erect horizontal chaetae at tip.

Claw without inner and lateral teeth. Empodial appendage about half as long as unguis, rather thin. Ti.1–3 with 21, 21, and 24 chaetae, respectively, without clavate tenent hairs. Two inner chaetae on Ti.3 much thinner than others (Fig. 3E). VT with 4+4 laterodistal and 4 posterior chaetae, no anterior chaetae. Tenaculum with 3+3 teeth and 1 chaeta. Anterior furcal subcoxa with (3)4 chaetae, posterior subcoxa with 3(4) chaetae. Manubrium without anterior chaetae, posterior with 3+3 laterobasal, 2+2 in distal transversal row, and 2+2 in central part. Dens with 1 anterior and 3 posterior chaetae, basal chaeta on posterior side slightly larger (Fig. 3C). Mucro massive, bidentate. Ratio of manubrium: dens: mucro = 6.5: 2.5: 1. Female genital plate as in Fig. 3C.

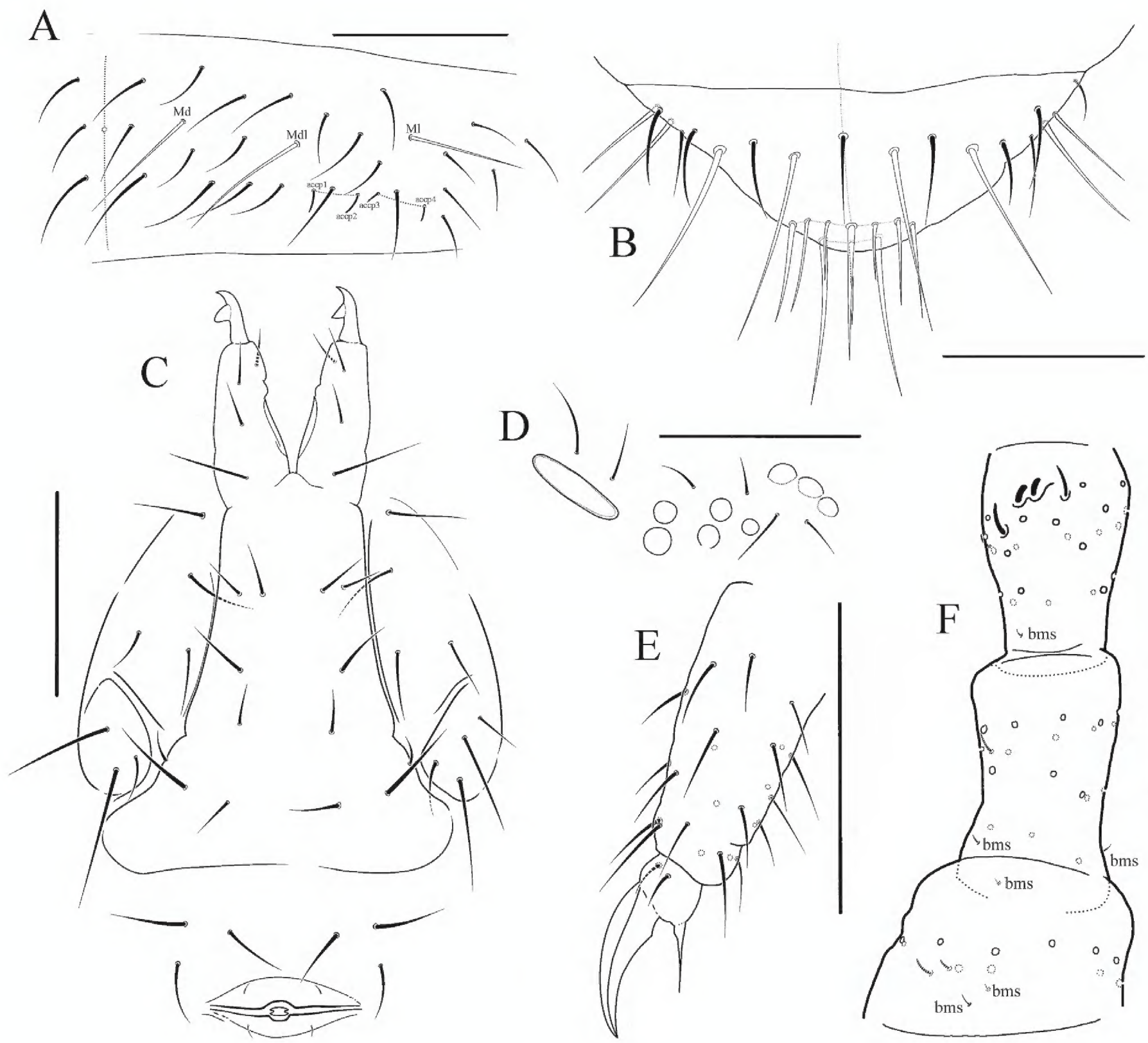

Figure 3. *Narynia ritongensis* sp. nov. **A** dorsal chaetotaxy of Abd.V **B** Abd.VI, dorsal view **C** furcal area and female genital plate **D** PAO and ommatidia **E** tibiotarsus and claw of Leg 3 **F** Ant.1–3, dorsal view. Scale bars: 50 µm.

Table 1. Diagnostic characters of *Narynia* species with dens of three posterior chaetae.

Character	*N. kolimiensis*	*N. luanae*	*N. alxaica* sp. nov.	*N. ritongensis* sp. nov.
Medial sensilla on Abd.I–III	posterior to Mdl	posterior to Mdl	posterior to Mdl	posterior to Mdl
Anterior/posterior chaetae on dens	1/3	1/3	1/3	1/3
Ventral chaetae on Th.III	0+0	1+1	0+0	0+0
Microsensilla on Th.III	interior to lateral s	between anterior and posterior s	between anterior and posterior s	between anterior and posterior s
Ratio lateral sensilla: medial sensilla on Abd.V	1: 1	1: 1.6–2.0	1: 1.6	1: 1.9
Location of accp1 on Abd.V	between Md and Mdl	between Md and Mdl	between Md and Mdl	between Mdl and Ml
Location of accp2 on Abd.V	between Md and Mdl	posterior to Mdl	between Mdl and Ml	between Mdl and Ml
Chaetae on Ti.3	24–25	22	22	24
Teeth on tenaculum	4+4	3+3	3+3	3+3
Chaetae on anterior furcal subcoxa	4	(4)5	4(3 or 5)	(3)4
Posterior chaetae on manubrium	8+8–9+9	(6)8–9+(6)8–9	9+(8)9	7+7
Ratio dens: mucro	2.2: 1	2.1–2.5: 1	2.5: 1	2.5: 1

Remarks. *Narynia ritongensis* sp. nov. is similar to *N. alxaica* sp. nov. and *N. kolimiensis* by the location of medial sensilla on Abd.I–III, no ventral chaetae on Th.III and the same chaetotaxy of the dens. Although *N. luanae* has 1+1 ventral chaetae on Th.III, this species also shares several characteristics with the other three species. The main similarities and differences between the four species of *Narynia* are listed in Table 1.

Distribution. Known only from the type locality.

Etymology. The new species is named after the type locality.

Key to species of the genus *Narynia*

1 Th.III with ventral chaetae **2**
– Th.III without ventral chaetae **4**
2 Abd.V with medial sensilla at most twice as long as lateral sensilla. Dens with at most 4 posterior chaetae **3**
– Abd.V with medial sensilla long, thin, 4 times longer than lateral sensilla. Dens with 5 posterior chaetae ..... ***Narynia setosa* Martynova, 1967**
3 Medial sensilla on Abd.I–III between Mdl and Ml. Dens with 4 posterior chaetae ..... ***Narynia andreevae* Martynova, 1975**
– Medial sensilla on Abd.I–III slightly posterior to Mdl. Dens with 3 posterior chaetae ..... ***N. luanae* Huang, Potapov & Gao, 2010**
4 Abd.V with medial sensilla long, thin, at least 1.6 times as long as lateral sensilla. Medial sensilla accp2 between Mdl and Ml **5**
– Abd.V with medial sensilla as long as lateral sensilla. Medial sensilla accp2 between Md and Mdl ..... ***N. kolimiensis* Martynova, 1981**
5 Ti.3 with 22 chaetae. Medial sensilla accp1 on Abd.V between Md and Md ..... ***N. alxaica* sp. nov.**
– Ti.3 with 24 chaetae. Medial sensilla accp1 on Abd.V between Mdl and Ml ..... ***N. ritongensis* sp. nov.**

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

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Author contributions

Investigation: CWH. Project administration: CWH. Writing – original draft: CWH.

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Data availability

All of the data that support the findings of this study are available in the main text.

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